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RESEARCH REPORT

TACTICAL AIR COMMAND

ELECTRONIC WARFARE AGRESSOR PROGRAM:

ONE OPERATIONAL CONCEPT

LT COL O. RAGIN HAUSE, JR

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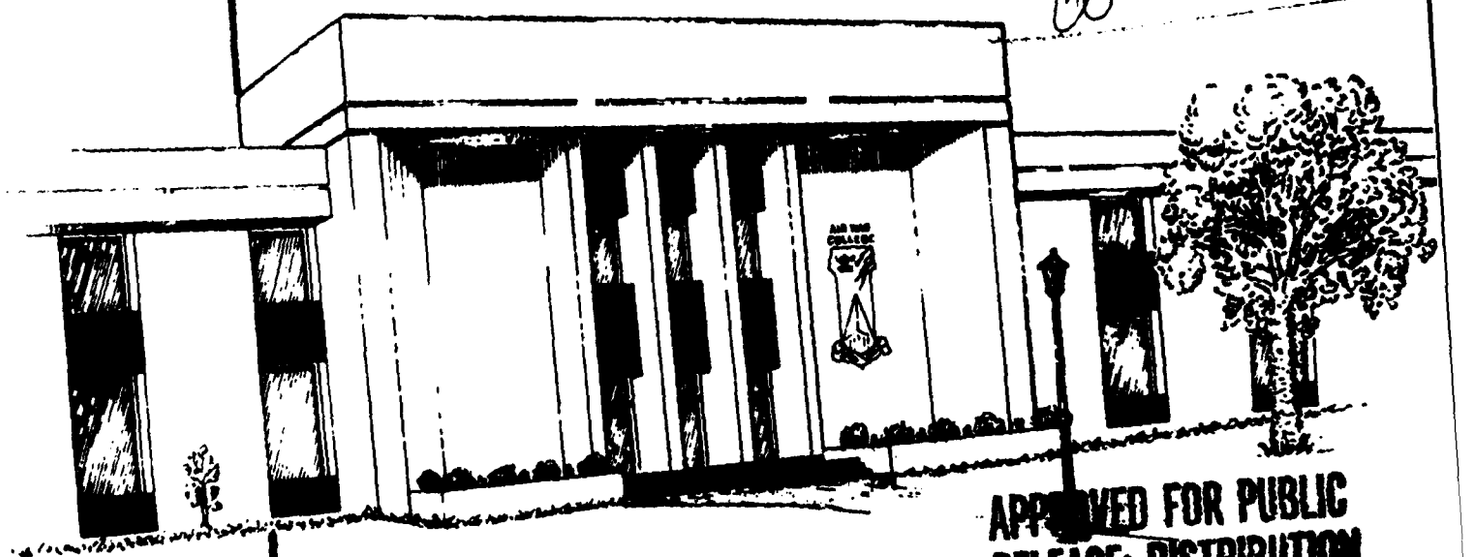

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TACTICAL AIR COMMAND ELECTRONIC WARFARE AGGRESSOR PROGRAM: ONE OPERATIONAL CONCEPT

by

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A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY

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EXECUTIVE SUMMARY

TITLE: Tactical Air Command Electronic Warfare Aggressor Program: One Operational Concept

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A discussion of current Air Force doctrine for electronic combat validates the requirement for the development of an electronic warfare capability in Tactical Air Command. Some difficulties in the training for and the sustainment of electronic combat in the command are described. An Electronic Warfare Aggressor Program started by the HQ TAC/LG that addresses these difficulties is described and the advantages pointed out. A concept of operations for this program is proposed that incorporates benefits for operations.

BIOGRAPHICAL SKETCH

Lieutenant Colonel O. Ragin Hause, Jr. (M.S., University of Southern California) has been interested in electronic warfare since performing duty as an F-4 Wild Weasel pilot in Okinawa from 1973 to 1976. This interest was recently renewed while serving as the commander of the 94th Tactical Fighter Squadron when the squadron and its associated aviation package participated in a Tactical Air Command exercise, Coronet Warrior I. The sustainability of the electronic warfare systems of F-15 aircraft was investigated thoroughly in that exercise. He served with the 497th Tactical Fighter Squadron in Southeast Asia as an F-4 pilot in 1972-73, and holds the Distinguished Flying Cross and Air Medal. Lieutenant Colonel Hause is a graduate of the Air War College, class of 1989.

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CHAPTER I

INTRODUCTION

Since the Battle of Britain when the Germans tried to deceive the British radars with aerially dispensed tin foil, air forces have been doing battle with electrons hurled at each other or reflected from false targets in attempts to guide weapons or to negate the guidance of those weapons. Today we call it Electronic Combat and have enormous amounts of money and materials invested in the capability. The problems along with the equipment have increased enormously in their complexity and difficulty.

The requirement for an Air Force capability to wage electronic combat is found throughout our doctrinal manuals and its importance to modern day air combat is certainly not understated. It is represented as central to the success or failure of our military operations.

Tactical Air Command experiences some difficulties in fulfilling the requirements of Air Force doctrine in the areas of training for and sustaining of an Electronic Combat capability. Opportunities for pilot training with the electronic combat systems are less frequent than desired. The ability to verify the proper operation of the electronic warfare systems could use some improvement from a maintenance viewpoint.

The TAC/LG has initiated some fixes for the problems

with the creation of Electronic Warfare Aggressor Program (EWAP) teams. Two teams are currently funded in TAC and these 20 person teams will travel to TAC bases and identify discrepancies in the unit's systems with the aid of some specialized equipment.

The program shows great promise to enhance the command's awareness of electronic warfare and its capability to sustain that capability. The teams as presently structured will help correct some nagging problems in the command's electronic warfare capabilities. The greatest benefit will probably derive from the command emphasis placed on electronic warfare and the drawing together of operations and maintenance in the pursuit of solutions.

With some changes to the present structure and operational philosophy of the program, operations could also benefit enormously from the increased emphasis on electronic warfare. I propose to structure the teams to provide beneficial training to the pilots as well as maintenance. Procurement of test equipment with better acquisition capabilities could provide a source of in-flight electronic warfare training for the pilots that would help correct a present training deficiency.

CHAPTER II

DOCTRINAL BASIS FOR ELECTRONIC COMBAT

Sometimes the mystery that surrounds Electronic Combat (EC) causes one to wonder if there is a plan coordinating, or even justifying, the considerable investment our armed forces have made in EC capability. It is from the United States Air Force mission statement that the requirements examined in this study derive. Air Force Manual 1-1, Basic Aerospace Doctrine of the United States Air Force, says that the Air Force, through its major commands, ". . . organizes, trains, equips, sustains, and provides operationally ready forces and their support elements to the unified and specified commands." (Emphasis added) (1:4-1) The combatant commands are, in turn, tasked with the employment of these forces. The training for the use of and the sustaining of our electronic warfare equipment are the areas of interest for this study.

Electronic combat (EC), which includes the areas of electronic warfare (EW); command, control and communications counter measures (C3CM); and the suppression of enemy air defenses (SEAD), is listed as an Air Force Specialized Task in AFM 1-1. The purpose of EC is to aid our war fighting systems, "since the use of the electromagnetic spectrum can have a major impact on the success or failure of military operations." (Emphasis added) (1:3-6)

Electronic warfare is that part of EC with which this study is concerned. EW is military use of the electromagnetic (EM) spectrum to, "determine, exploit, reduce, or prevent hostile use," of that spectrum. (1:3-6,7) For Tactical Air Command fighter, attack, and reconnaissance aircraft this means the use of radar warning receivers (RWR) to determine and possibly exploit the enemy's EM actions. It also includes the use of electronic counter measures (ECM) pods or internal ECM gear to either reduce the enemy's effectiveness or prevent his use of the EM spectrum.

General Curtis E. Lemay said that doctrine, ". . . represents the central beliefs for waging war in order to achieve victory." (1:title page) If we desire to train and equip like we will fight, it follows that doctrine gives direction to our training and the procurement of our weapons systems. "The requirement for prompt and sustained operations demands the development and maintenance of an adequate and timely logistics capability." (Emphasis added) (1:4-9)

An older (1979) but still valid doctrinal manual, Air Force Manual 1-9, Doctrine for Electromagnetic Combat, reflects Air Force thoughts about EW with a well chosen statement from Dr. Malcolm Currie: "It must be transformed into a well-planned and integral part of our systems capabilities, of our military doctrine, and of our training." (2:1-1) Dr. Currie accurately forecast in 1976 that systems, doctrine and

training would be the keystones of our EC capabilities. I would argue that our systems are capable but need additional techniques for sustainment; our training suffers from lack of opportunity; and our doctrine is fundamentally sound.

The Air Force position on the applicability of EC to all levels of conflict is stated in AFM 1-9 as: "Regardless of the level of armed conflict, control of the electromagnetic environment is as important to successful air combat as are firepower and maneuver." (2:1-1) EC is thus equated in our doctrine to some time honored principles of war. It is a reflection of the effectiveness of our present technology that "electronic gadgetry" is equated to firepower.

In AFM 1-9 we learn that the goal of the USAF is to control certain parts of the electromagnetic spectrum. Control, as the operative term, implies denial of the enemy's use of those parts of the spectrum while retaining their use for our forces. Doctrine for Electromagnetic Combat goes on to warn us that the decisions we make as we seek to control parts of the EM spectrum are critical and can jeopardize operations or even whole campaigns.

On the logistic side, AFM 1-9 says we must be prepared to conduct EW effectively over long periods of time. The key to this sustained capability is found in this sentence: "Logistic support is a critical determinant of operational capability." (2:2-15)

In AFM 2-8, Electronic Combat (EC) Operations, the ap-

plicability of EC actions to a peacetime environment is stated as, ". . . to develop and maintain a wartime capability." (3:5) Key to the success of our peacetime efforts are EC ranges where the equipment and personnel can exercise their EC capabilities. "EC ranges play an integral part in training and testing the effectiveness of present and projected tactics, techniques, and equipment by simulating the expected EM environment." (Emphasis added) (3:5)

USAF doctrine requires an EC capability with a goal of control over parts of the EM spectrum. Major commands are charged with training personnel to operate and maintain the equipment that provides our EC capability. When these tasks are accomplished our pilots are provided with the capability to lower attrition rates as they perform their wartime missions. If the pilots are not trained correctly or the equipment not maintained properly, then higher attrition rates will result.

CHAPTER III

DIFFICULTIES IN SUSTAINMENT AND TRAINING

Tactical Air Command presently experiences difficulties in the development of an electronic combat capability as required by Air Force doctrine in the areas of training and sustainment.

The EW training events required of each pilot by TACM 51-50 during the six month training cycle are extremely difficult to accomplish if a Red Flag exercise is not available for that pilot. (4) These EW training events require maneuvering airspace for tactics execution, a threat radar simulator and the ability to exercise the aircraft's ECM systems. Those requirements all come together at the Nellis AFB ranges and the pilots receive superb training with meaningful and timely feedback on their degree of success in countering the threats. If there are no Red Flag missions available for the pilot that half, he's largely out of luck. The requirements for the training can be satisfied at only a very few of the other ranges available and do not approach the quality available at Red Flag.

This lack of hands-on training in operation of his EW systems and their integration into his tactics with feedback creates a less than optimally trained pilot in the EW arena. The pilots are unfamiliar with the normal operations of the equipment and are unaccustomed to identifying and compensat-

ing for degraded operations.

At the same time maintenance experiences difficulties in correcting those discrepancies the pilots identify through the equipment's built-in-test (BIT) features. A pilot that suffers from a lack of hands-on operation of the equipment is not as proficient in identifying systems failures and interpreting BIT fault indications. The write-up that reports the discrepancy to maintenance for corrective actions is often frustrating to the technician because of shallow, incomplete, or incorrect descriptions of the problem. The maintenance test equipment can only provide static ground tests and cannot duplicate the dynamic flight environment in all cases. Poor write ups and limited diagnostic capabilities combine to produce an inordinate amount of "could not duplicate" (CND) answers from maintenance to the pilot's write ups. These are frustrating for maintenance and confidence degrading for operations.

The present maintenance diagnostic and test capability for EW systems does not uncover all the faults in the equipment. Two TAC exercises, Coronet Warrior I and II, demonstrated this fact and highlighted some of the problems with the sustainment of EW systems.

The exercises, performed with F-15 and F-16 squadron aviation packages respectively, were designed to gather data on the suitability of the War Readiness Spares Kits (WRSK) that were developed with the aid of DYNAMETRIC computer mod-

els. The units were isolated for 30 days and tasked to fly at wartime rates with their WRSK kits being their only source of supply. The sustainability of the EW systems was one of the prime areas of interest for data gathering. Ground checks were performed on the EW systems each day before take-off and most of the sorties were also subjected to in-flight checks of the systems with the use of threat radar simulators and signal analyzers. During Coronet Warrior I (F-15) 659 sorties (67 per cent of total sorties) were subjected to an in-flight check with 88 sorties (13%) showing some discrepancy. The pilot was aware of the discrepancy less than half the time (40 sorties). (5:29) Coronet Warrior II (F-16) subjected the aircraft to much more extensive ground checks before each flight and provided feedback to the unit for maintenance actions. In-flight checks performed on 613 sorties produced 51 write-ups on the EW systems -- only five were pilot reported. (6:16) The implications for the selection of tactics in combat when the status of the EW systems is essentially unknown are enormous.

The Electronic Warfare Evaluation Program (EWEP) managed by the Tactical Air Warfare Center is designed to assist TAC units in sustaining their EW systems. The radar threat simulators and signal analyzers available there are very helpful to a unit in verifying the status of their EW systems. Unfortunately the opportunity for a unit to run its aircraft through EWEP is almost nonexistent. An alternative

exists at the Nellis AFB ranges but the opportunity, while greater, is still insufficient. Both ranges are heavily scheduled and the priorities of a fighter unit for range time are much lower than those for test and evaluation and other missions.

CHAPTER IV

TAC ELECTRONIC WARFARE AGGRESSOR PROGRAM

It was obvious in the previous chapter's examples that the sustainment of our EW systems required by Air Force doctrine can use some technical assistance. The most telling example is probably that of Coronet Warrior II in which 613 sorties were evaluated for F-16 EW systems performance and produced 46 "write-ups", or discrepancies that were not previously discovered by the pilots with their built-in-test (BIT) systems. (6:16) These statistics point out some of the short falls of the BIT features of the EW gear for identifying degraded operations to the pilot. Expanded test procedures for maintenance personnel are needed to insure the pilots have EW systems in which they can have confidence during combat.

The TAC concept for providing this needed additional evaluation is an Electronic Warfare Aggressor Program (EWAP) that mobilizes ground test teams to evaluate a fighter wing's passive and active EW systems. The program is under the functional management of the Tactical Air Warfare Center (TAWC) at Eglin AFB, Florida which is the command's single manager for electronic combat. During Coronet Warrior II, 10 May - 9 June, 1988 at Shaw AFB, the concept was validated and proven workable from a maintenance viewpoint. (6:16) Operational impacts were present but, as I will address later,

could be lessened in their impact or even turned into operational benefits.

Two EWAP teams have been funded for FY 89. The identified costs for a one year trial period are $347,900. (7:1) This includes four deployments each of approximately 14 days duration. The twenty person teams include technicians to test both EW pods and RWR systems. The units will augment the teams with additional technicians.

Two visits a month at 14 days per visit would keep one team on the road constantly. Travel time (and expense) is not a small concern when one team has a CONUS-wide mission. For these reasons, and to furnish a shorter span of control along with more frequent visits, two EWAP teams were formed --one for 9 AF and one for 12 AF. Basing for the two teams is at Avon Park, Florida for 9AF and Mountain Home AFB, Idaho for 12AF. (8:4)

The long-term equipment picture would have specialized equipment procured for the task. A stand-alone ramp/range end-to-end tester is on order for the teams and should be available for Coronet Warrior III (A-10) scheduled at England AFB, Louisiana during the period 17 April through 16 May 1989. (9:2) This air transportable, ruggedized equipment shows promise for the EWAP mission and TAC has expressed interest in obtaining the equipment for each fighter unit.

The concept of operations has the team arriving as per a pre-published schedule and settling in and setting up on day

one -- typically Monday. After set-up a 100 per cent ground check will be made of the EW systems in the unit's aircraft using the ramp testers. Discrepancies would be immediately identified to the unit technicians and any necessary expertise to fix the systems would be made available from the EWAP and augmenting technicians. The resulting on-the-job-training (OJT) for the unit technicians will certainly increase the expertise and experience level of the unit's EW technicians.

Simultaneously, at a site close to the unit with airspace available overhead, the radar threat simulator and signal analyzer equipment will be set up. In-flight checks of the EW systems in the unit's aircraft will be made as they complete sorties in the normal daily flying schedule. This in-flight check will require, dependent on location, 15 to 30 minutes of flight time. This will impact on the training accomplished by operations as present equipment combined with airspace limitations preclude aircraft maneuvering during the checks. As I will discuss in the next chapter, acquisition enhancements and operator experience will correct these shortcomings and allow valid pilot training in avoiding and countering these radar signals while still obtaining a valid check in all but the most extreme cases.

If everything goes "according to plan" the EWAP team would depart on the 14th day leaving behind a unit whose EW systems have been thoroughly tested and corrected where

faulty. The unit EW technicians would have experienced two weeks of intense work on the systems with the opportunity for OJT with experts in the field.

Similar to the USAF "flying" Aggressors the EWAP teams will have as their primary objective the enhancement of our combat capabilities. In addition to in-flight training against Soviet tactics the Aggressors accomplish that objective by classroom and training on enemy tactics. I will explain in the next chapter how the same philosophy could apply to EWAP. The benefits that will arise from the EWAP program as conceived now are many and diverse.

The greatest benefit will be the emphasis that will be placed on EC for, at least, the two weeks that the team is on base. If nothing else, it sends a very clear signal that TAC cares about EW and is working hard to enhance their capability in this vital arena of combat. A fighter wing that "thinks EC" for two weeks has focused a lot of talent and ingenuity on a nagging problem. Some fixes will result.

Other benefits will derive from the presence and help of the very experienced technicians that make up the EWAP teams. The on-the-job-training provided to the unit technicians will be invaluable. Testing all of TAC's aircraft will enable the FWAP team to have their finger on the pulse of EC in the command. The trending of the data obtained during team visits will allow corrections to be made throughout TAC.

The TAC/LG has concluded that the EWAP program is a

proven alternative to the electronic warfare evaluation program (EWEP) and low cost for the increase in confidence. (8:9)

CHAPTER V

ONE OPERATIONAL CONCEPT

I have no doubts that an electronic warfare program that focuses entirely upon the maintenance side of the house is handicapped from the start. EWAP almost stands alone without need of justification -- it is so obviously good and a "fix" for systems that have been troublesome and wrapped in mystery to the operators in Air Force history. The program will run headlong into "operational requirements" and lose some vital support. If operations is not intimately involved in the program the cry will go up that maintenance is telling operations how to fly the aircraft and the in-flight tests will go down in percentages accomplished. Operations will not be as cooperative (maybe to the point of opposition) with the scheduling of team visits due to the loss of mission training caused by straight and level profiles over the radar threat simulators and signal analyzers during the in-flight checks. These in-flight checks will consume the last 15 to 30 minutes of flight time to check the RWR and jamming systems and represent a significant percentage of the training accomplished on fighter sorties that are intensive in level of activity from takeoff to landing.

The loss of training time could be mitigated. The pilots need the training in EW areas. If the EWAP teams become teachers as well as testers then operations and maintenance

will find complimentary benefits in the program. EWAP as an "inspector" or "evaluator" should not be the tone of the program.

The Weapons System Evaluation Program (WSEP), as a similar example, suffers from an "it's a test" environment in my opinion. WSEP purportedly gathers data upon <u>representative</u> weapons systems by bringing together the generic pilot, weapon and aircraft in an employment scenario that provides statistics on the systems reliability. In my experiences at WSEP (air-to-air missiles) the attitude of the WSEP people precluded any sharing of their considerable experience in employment of air-to-air missiles because it was an evaluation and instruction would have affected the results.

The employment of weapons is a very satisfying and valuable experience to the fighter pilot -- WSEP is a much sought after experience as a result. The trading of electrons between fighters and ground test sites is not going to arouse the same emotions in a fighter pilot as the launch of an AIM-7 missile against a full scale drone.

At another place on the scale is the USAF Aggressor program. What's the difference? The Aggressors "keep their mouth shut" and do not compare unit effectiveness except in confidential reports to senior leaders. This is necessitated in some part by the intensely competitive nature of air-to-air combat - too much competitiveness in that environment could lead to dangerous situations when the

adrenaline level gets too high. Pride makes you work hard, but smart, to beat the Aggressors -- not the fear of a bad report card. The Aggressors also advertise as one of their objectives that they would like to help the fighter pilots acquire the skills and knowledge necessary to beat them in air-to-air combat. The Aggressors are teachers not evaluators.

Thus a big difference between the Aggressors and WSEP is the training received. The Aggressors always arrive with many slide trays full of the latest Soviet weaponry and tactics, eager to teach. WSEP doesn't teach about the weapons - they evaluate. Aggressor success is measured by the success of the pilots they fly against; WSEP success is measured in statistics.

EWAP must fall somewhere on the scale between WSEP and the Aggressors. The attitudes of the Aggressors are closer to what is desired for EWAP than that of WSEP. EWAP is an excellent vehicle to disseminate information about the threat and the capabilities of our systems to our pilots. At the same time, our capabilities in EW would benefit from some hard data to direct our training, procurement and maintenance. What is the average pilot's level of understanding and ability to use his EW suite? How many of our EW systems are working as designed? Are there trends in either area? EWAP can provide some answers to these questions with testing at the start of a visit and by gathering data during the

whole visit upon the systems. An EWAP team should view as preeminent success a visit (after their first few) to a unit in which they were unable to find any discrepancies in the unit's EW systems or knowledge. A very low level of discrepancies after some maturity for the program would indicate success in teaching a unit to use their internal resources to sustain their systems. It also indicates success in forming an attitude in the pilots that EC is important and that fosters cooperation with maintenance in reporting and helping to correct problems with the equipment. I suspect that an increased level of knowledge on system operations and capabilities on the part of the pilots and technicians will cause a decrease in the number of discrepancies that maintenance ends up signing off as "could not duplicate".

An electronic warfare officer is proposed as team chief for the teams. This highly trained individual should be used to teach mandatory classes to the pilots of the units visited on the enemy's radio electronic warfare capabilities and the capabilities and operations of unit equipped systems in countering them. The EW technicians would benefit from a brief (one or two hours), classified look at the enemy's integrated air defense system (IADS). I can imagine no better motivator to maintain the equipment "full-up" than an appreciation of the threat that their pilots will be going up against.

The EW technicians that make up the team should spend at least an equal amount of time training the unit's technicians

in maintenance techniques. An EWAP technician's store of experience and techniques will very quickly surpass the information in the technical orders. This expertise must be passed on to the field if the program is to be judged a success. Classroom, or shop, instruction must accompany the OJT inherent in the program if all the technicians are to be reached.

As mentioned earlier, operations will probably have some initial objections to the loss of training caused by the rigidly controlled fly-over path necessitated by the acquisition capabilities of present radar signal simulators. Presently to fulfill the requirements of the electronic warfare training events called for in TACM 51-50, maneuvering flight (jinking, terrain masking, evasive maneuvers, etc.) is called for in reaction to RWR detected threats. These tactics are not possible with presently available equipment as it will lose track due to aircraft maneuvers. The future acquisition of more capable equipment, located under the proper airspace will remove these objections and provide training opportunities that do not presently exist except at a very few ranges such as Red Flag. The ideal would be radar threat simulators with the capabilities of those presently found at the Nellis ranges with the addition of signal analyzers to check the ECM generated. Until such time as that equipment is procured, there will be a loss of training time for operations. In my opinion, the benefits to our combat capability outweigh the

loss of in flight training. Classroom instruction for the pilots mitigates in a small way the loss. Supervisory involvement will help the younger fighter pilots understand the big picture until better equipment that adds training is procured.

A mass visit by all the unit's aircraft to EWEP at the end of the team's visit would provide an outstanding opportunity for a generation and mass launch plus valuable feedback from the more capable analysis of EW systems available there. This was done very successfully at the end of Coronet Warrior I and II. This should ease the present scheduling problems at EWEP -- approximately a four hour block of range time will suffice to check a squadron's aircraft. A last choice position would be to accomplish these checks on the weekend.

CHAPTER VI

CONCLUSIONS

Air Force doctrine requires the development of an electronic combat capability for our combat forces. This capability must include training for operators and technicians. A logistical capability to sustain these systems is vital to our electronic warfare capabilities.

There are deficiencies in pilot training and maintenance diagnostic capabilities in the electronic warfare arena. Present training opportunities for pilots are limited. The capability of built in test equipment to identify degraded operations of EW equipment is not infallible. Likewise, maintenance test equipment does not always identify system discrepancies during ground checks. Opportunities to perform in-flight checks of EW systems are very rare because of other, higher priority missions at the ranges that can perform these checks. Pilot confidence in the systems is adversely affected by all of these shortcomings.

The Electronic Warfare Aggressor Program initiated by the TAC/LG shows great promise to correct most of the present shortcomings. The EWAP concept of two traveling teams, 9AF and 12AF, under the management of TAWC will provide home base testing, ground and in-flight, of the EW systems in the unit equipped aircraft. Technical assistance is inherent in the make up of the teams and will assist the units with

correction of identified discrepancies. Valuable training of the unit EW technicians will accompany the maintenance and testing process. The program will also gather data and help with the identification of command-wide or equipment peculiar trends.

Some degradations of operational training will be incurred until more capable threat radar simulators and signal analyzers are procured. The benefits to combat capability outweigh the degradations to training. The EWAP concept of operations should steer away from being an evaluation or inspection function and concentrate on training the personnel at the units visited. The opportunity to have a unit "think electronic warfare" for the period of the visit will pay large dividends. The opportunity for formal classroom instruction in enemy and own capabilities as well as systems operations should not be passed up. Great benefits will also be derived from the OJT received by the unit technicians and the hands on operational time with the EW systems for the pilots.

EWAP is worth the cost.

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GLOSSARY

AFM	Air Force Manual
BIT	Built-in-test
CND	Could not duplicate
C3CM	Command, Control, and Communications Counter Measures
EC	Electronic Combat
EM	Electromagnetic
EW	Electronic Warfare
ECM	Electronic Counter Measures
EWAP	Electronic Warfare Aggressor Program
EWEP	Electronic Warfare Evaluation Program
IADS	Integrated Air Defense System
OJT	On-the-job-training
RWR	Radar Warning Receiver
SEAD	Suppression of Enemy Air Defenses
TAC	Tactical Air Command
TAC/LG	Deputy Chief of Staff for Logistics, TAC
TACM	TAC Manual
TAWC	Tactical Air Warfare Center
WRSK	War Readiness Spares Kit
WSEP	Weapons System Evaluation Program